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EVALUATION OF UDDER MEASUREMENTS AND MILK COMPOSITION OF TWO BREEDS OF SHEEP IN MAIDUGURI BORNO STATE OF NIGERIA

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ABSTRACT

The evaluation of udder measurement and milk composition of two breeds of sheep were assessed. A total of one hundred and sixty sheep comprising of (80 Yankasa and 80 Uda breeds of sheep. Matured ewes were used, age ranges between 2- 4 years of age and with average body weight of 30 - 40kg.The udder characteristics were measured using flexible tape, vernier caliper, while body weight was measured using weighing balance. Milk qualities were analyzed for fat%, protein % lactose%, solid and non-solid fat% and vitamins %. The body weight (BW), udder length (UL) and udder volume (UV) were significantly affected by breed with Yankasa breed having the higher value of 40.93±2.1 kg, 14.19±0.54cm and 1.31±0.11m^3 followed by Uda breed 37.37±1.50 kg, 12.11±0.37cm and 0.95±0.07 m^3. Strong positive and significant correlation was recorded between udder width and udder volume (r =0.79**), udder length and udder volume (r =0.78**) while moderate correlation was observed between udder width and udder circumference (r =0.53**). There was significant difference (p<0.05) during lactation in value of udder length 13.70cm, udder weight 12.88kg, udder circumference 4.15cm, udder volume 1.25m^3, teat length 2.71cm, teat width 1.67cm and distance between teat to floor 6.53 cm was higher in Yankasa breed than Uda breed. There was significant difference (p<0.05) with Yankasa breed ewes during pregnancy which had higher body weight 42.99kg, higher udder length 14.68cm, udder width 12.49cm, and udder volume 1.37m^3 as compared to Uda breed There was significant variations in the shape of the udder with Yankasa funnel shape with higher value of body weight 43.32kg, udder length 14.33cm, udder width 12.99cm and udder volume 1.37 m^3 followed by Yankasa bowl shape with the value of body weight 38.55kg, udder length 14.05cm and udder width 12.38cm as compared to the Uda breed. lactose and casein percent content varied significantly between the breeds with Yankasa ewes having the higher value of lactose (4.51 %) and casein (3.43%).

Keywords: Yankasa and Uda breed, Milk composition, Udder Measurements, Lactation, Pregnant

INTRODUCTION

Sheep contributes enormously to the protein requirements of most developing countries. In Sub-Saharan Africa, sheep provides almost 30% of the meat consumed and around 16% of the milk produced (Mandel *et al.,* 2007). Sheep rearing is one of the most important means of livelihood and food security for majority of the rural populace, especially in developing countries (Birteeb *et al.,* 2012). The indigenous cattle are the major source of milk supply. The udder is a very important gland in reproductive animals for milk production, milking rate and time. Several studies have confirmed that udder and teats characteristics are important determinants of milk yield and milking ability in dairy animals (Abu *et al.* 2013). Better knowledge of morphological udder trait variability allowed the identification of mammary trait most suitable for incorporation into selection programs for dairy sheep breeds (Makovicky *et al.,* 2014). Interrelationship among udder measurements and milk yield within sheep have been demonstrated, yet not fully investigated. In dairy sheep, the most important functional traits are those related to udder morphology. Evaluating of udder morphology can be performed by direct measurement of the udder (Sadeghi *et al.,* 2013). Sheep milk has been used by man since the beginning of sheep domestication, and its heath potential has been reported by several authors. In South America, sheep milk products are traditionally made by hand, using raw milk without the addition of dairy cultures, this differentiates the products by their typical flavors and aromas (Medina *et al.,* 2011). Sheep milk has sweet soft flavor, aroma and is creamy texture due to the presence of the small fat globules dispersed in milk, making it more easily digested (Parka *et al.,* 2007). The objective of the study was to evaluate udder and teat measurements of two breeds of sheep and the milk.

MATERIALS AND METHODS

Study Area

The study was conducted in Maiduguri, Borno state. Maiduguri is situated on latitude 1105'N and longitude 13009E and at an altitude of 354m above sea level. The area falls within the Sahelian (semi-arid) region of West Africa which is noted for its great climatic and seasonal variation. It has very short period of rainfall about 3-4months given 645.9 mm of precipitation per annum with a long dry season of about 8-9 months. The temperature could be as low as 200C during the dry cold season (October-January) and as high as 300C during the dry hot (February-May) season. Relative humidity is 5% in April and 60% in August; day length varies from 11-12 hours (Raji *et al.*, 2013).

Study Animals

A total of one hundred and sixty sheep (160) were used for the study. Comprising of 80 Yankasa and 80 Uda breeds respectively. There are other breeds like balami, Koroji and west African dwarf but these two breed Yankasa and Uda breed are in abundance. The animals were randomly selected at the Maiduguri abattoir Cattle market (Kasuwan shanu). The animals were brought from different parts of the state for sales and slaughter.

Data Collection

The animals where restrained in a standing position or recumbent position depending on the parameter to be taken.

The breed and the physiological parameters of the ewe were recorded. The udder characteristics were measured using flexible tape and meter rule as described by (Akpa *et al.,* 2001) as follows.

- Udder circumference cm (UC)-This was measured as the distance at the widest point of the teat.
- Udder Length cm (UL)-This was measured as the distance between the base of the udder attachment to the abdominal region.
- Udder Width cm (UW) -This was measured as the distance between the widest points of the udder.
- Distance between the teats cm (DT) -This was measured between the bases of the two teams.
- Teat length cm (TL)-This was measured as the distance from upper part of the teat, where it hangs perpendicularly from the udder to the tip of the teat.
- Teat width cm (TW)-This was measured as the distance between the widest points of the teat.
- Teat height to ground cm (THG)-This was measured as the distance between teat tip to ground.
- Udder volume m^3 (UV) -This was obtained using the formula.

$V=4/3\ \pi\ r^3$

Where $r = (UL+UW)/4$

According to (Amoa, 1999).

Milk Sample Collection

Before the collection the collector hand was sanitized with isopropyl alcohol 70 % ethanol and sterilized gloves were used during collection of the samples to avoid contamination. Milk sample of (100ml) was collected in sterile tubes directly from the udder. Milk sample were collected from 10 ewes per breed postpartum by hand milking procedure to determine the milk composition of two breeds of sheep. The milk sample was collected in sterile tube and immediately transferred in to an ice box before taken for milk quality laboratory analysis. Milk quality was analyses for fat %, protein %, lactose %, solids non-solid fat %, and vitamins %.

Determination of milk

Milk sample was analyzed for total solids (TS), crude protein (CP), butter fat, solid non-fat (SNF), ash and lactose. Total solid (TS) was obtained by drying 5.0g milk sample to a constant weight at 105^0C for 24 hours. Butter fat was estimated by the Rose Gottlied method. Milk protein (total protein is the nitrogen in milk multiply by N×6.38) was determined using the semi-micro distillation method using Kjeldahl and Markham′s apparatus. Ash content was obtained by drying and ashing a weight milk sample (10ml) to a constant weight at 550^0C for 48 hours. Lactose content was determined from fresh sample using standard procedure according to (Ozung *et al.,* 2019).

Statistical Analysis

All data generated were subjected to analysis of variance using SPSS version 20 difference between means were separated using Duncan multiple range test. Pearson correlation was used to determine the relationship between the udder characteristics and body weight.

RESULTS AND DISCUSSION.

The effect of breed on udder and teat measurements of two breed of sheep.

It was observed that there was significant difference (p<0.05) in the value of body weight 40.93± 2.1kg, udder length 14.19 ± 0.54 cm, and udder volume 1.31 ± 0.11 m^3 in Yankasa breed as compared to Uda breed with the corresponding value of body weight 37.37±1.50 kg ,udder length 12.11±0.37 cm ,and udder volume 0.95±0.07 m^3 . There were no significant difference (p<0.05) between udder width 12.14±0.15cm, udder circumference 3.56± 0.26cm, teat length 2.65±0.15cm, teat weight 1.62±0.15cm, distance between teat 5.59±0.41cm, and teat to floor distance 40.49±1.18cm of Yankasa compared to the Uda breed with value of udder weight 12.51±0.25cm,udder circumference 3.89±0.18cm, teat length 2.55±0.10cm, teat weight 1.46±0.11cm, distance between teat 5.85±0.28cm and teat to floor distance 41.18± 0.70cm respectively as presented in table 1 .The present study is similar with the findings of Dzidic *et al*. (2004) who observed significant difference of breed and udder measurement the study was conducted in Radosevic in Brtonigla Istria Croatia . Significant difference was also found between breed and crossbred sheep population of udder and teat measurement (Labussiere *et al.,* 1998, Kukovics *et al.,* 1993 and 1999) respectively.

Table 1: Effect of breed on udder and teat measurements of two breeds of sheep.

Parameters	Yankasa	Uda
BW (kg)	40.93 ± 2.17^{a}	37.37 ± 1.50^{b}
UL(cm)	14.19 ± 0.54^{a}	12.11 ± 0.37^{b}
UW (cm)	12.14 ± 0.56^{ns}	12.51 ± 0.25^{ns}
UC (cm)	3.56 ± 0.26^{ns}	3.89 ± 0.18^{ns}
UV (m^3)	1.31 ± 0.11^{a}	0.95 ± 0.07^{b}
TL (cm)	2.65 ± 0.15^{ns}	2.55 ± 0.10^{ns}
TW(cm)	1.62 ± 0.15^{ns}	1.46 ± 0.11^{ns}
DBT(cm)	5.59 ± 0.41^{ns}	5.85 ± 0.28^{ns}
TFD(cm)	40.49 ± 1.02^{ns}	41.18 ± 0.70^{ns}

Whereas BW: body weight, UL: udder length, UW: udder weight, UC: udder circumference, UV: udder volume, TL: teat length, TW: teat weigh, DBT: distance between teat, TFD: teat to floor distance.

Pearson correlation of udder and teat measurement of sheep

The relationship between udder width and udder volume revealed strong positive and significant correlation with the value of (r = 0.79**) followed by udder length and udder volume (r =0.78**). Positive significant and moderate correlation was observed in the relationship between UW and UC with the value of (r = 0.53**) presented in table 2. This implies that increase in one trait may lead to increase in the other traits respectively at a moderate level. The present findings agrees with the work of Maria *et al.* (2011) who reported that mammary trait showed significant linear correlation with milk yield, udder circumference and udder width. The rest of the morphological traits were not affected by breed factor, despite milk yield difference between chilota and Suffolk Down sheep. Emediato *et al.* (2008) reported positive correlations between milk yield and circumference, udder depth and udder width (r = 0.74, 0.75, 0.62, respectively) in Bergamasca ewes. Ayadi *et al.* (2011) evaluated mammary morphology and milk production in Sicilian Sarde dairy sheep milk yield and reported a positive and significant correlation with udder volume and udder length. There were low, positive correlations between udder volume, udder circumference, udder width, udder length with teat length with their corresponding values (r = 0.30, 0.27, 0.24, 0.22). Komanikis *et al*. (2009) found correlation between the length of teat and the reduced milk yield, while other external teat traits (teat width and teat angle) were not related to the yield. Negative correlation (from low to moderate value) between teat dimension and milk production. (Fernandez *et al*.,1997). However, Pripic *et al*. (2014) found that there was a positive and significant correlation between teat width and milk yield in sheep.

Table 2: Combined Pearson correlation of udder and teat measurements of sheep

	BW	UL	UW	UC	UV	TL	TW	DBT	TFD
BW(kg)	1								
UL(cm)	0.11	1							
UW(cm)	0.13	0.38**	1						
UC (cm)	- 0.09	0.12	0.53**	1					
UV(m^3)	- 0.03	0.78**	0.79**	0.46**	1				
TL (cm)	0.12	0.22**	0.24**	0.27**	0.30**	1			
TW (cm)	- 0.14*	0.23**	0.33**	0.33**	0.37**	0.36**	1		
DBT(cm)	- 0.00	- 0.17*	- 0.11	0.03	- 0.16*	- 0.14	- 0.22	1	
TFD (cm)	0.19*	-0.09	- 0.05	0.11	- 0.12	- 0.02	0.26**	1	

Whereas BW: body weight, UL: udder length, UW: udder weight, UC: udder circumference, UV: udder volume, TL: Teat length, TW: teat weight, DBT: distance between teat, TFD: teat to floor distance.

The variation of udder and teat measurement of two breeds of sheep during lactation and pregnancy.

The variation of udder and teat measurement during lactation is presented in table 3. It was observed that there were no significant difference during lactation with respect to body weight but there was significant difference in the value of udder length 13.70cm, udder weight 12.88cm, udder circumference 4.15cm, udder volume 1.25m^3, teat length 2.71cm, teat width 1.67cm and distance between teat to floor distance 6.53 cm in Yankasa as compared to Uda breed with value of udder length 11.78cm, udder weight 12.12kg, udder circumference 3.94cm, udder volume 0.92m^3, teat length 2.58cm, teat weight 1.48cm, and distance between teat to floor 6.23cm respectively. It was observed that the lactation ewes have a smaller udder and teat trait. The observation is in agreement with the finding of Amoa (1999). The observed trend could be attributed to mammary involution that occur when lactation and milk removal cease in sheep. Strange *et al.* (1992) explained a rapid loss of tissue function, degeneration of alveolar structure and massive loss of secretory epithelial cells leading to the programmed cell death or apoptosis that characterize mammary ovulation.

Table 3. Variation of udder and teat measurements of two breeds of sheep during lactation.

Breeds	BW	UL	UW	UC	UV	TL	TW	DBT	TFD
Yankasa	38.88	13.70	12.88	4.15	1.25	2.71	1.67	6.53	42.48
Uda	39.93	11.78	12.13	3.94	0.92	2.58	1.48	6.23	43.36

Whereas: BW: body weight, UL: udder length, UW: udder width, UC: udder circumference, UV: udder volume,TL: teat length, TW: teat weight, DBT: distance between teats, TFD: teat to floor distance.

Variation of udder and teat measurement during pregnancy

The variation of udder and teat measurement of two breeds of sheep during pregnancy is presented in table 4 it was observed that there was significant difference ($p<0.05$) in udder and teat measurement during pregnancy. The Yankasa ewes during pregnancy have a higher body weight 42.99kg, higher udder length 14.68cm, udder width 12.49cm, and udder volume 1.37m^3 followed by Uda breed with the value of body weight 34.81kg, udder length 12.45cm, udder width 11.80cm, and udder volume 0.99m^3 respectively. However, there was no significant difference between teat length and teat weight. This observation agrees with the finding of (Hurley, 2006). The pregnant ewes were superior to the lactation one, larger udder size may result from extensive of lobuloalveolar development during pregnancy cause by the influence of pregnancy hormone including placental lactogen, estrogen, progesterone, growth hormone, insulin and thyroid hormone.

Table 4. Variation of udder and teat measurement of two breeds of sheep during pregnant

Breeds	BW	UL	UW	UC	UV	TL	TW	DBT	TFD
Yankasa	42.99	14.68	12.49	2.97	1.37	2.59	1.56	4.65	38.49
Uda	34.81	12.45	11.80	3.85	0.99	2.51	1.44	5.46	39.00

Whereas: BW: body weight, UL: udder length, UW: udder width, UC: udder circumference, UV: udder volume, TL: teat length, TW: teat weight, DBT: distance between, TFD: teat to floor distance.

Variation of udder shape of two breeds of sheep

The variations in udder shape of two breeds of sheep is presented in table 5. There was significant variation in the shape of the udder with Yankasa funnel shape have a body weight 43.32kg, udder length 14.33cm, udder width 12.99cm and udder volume 1.37 m^3 followed by Yankasa bowl shape with body weight 38.55kg, udder length 14.05cm and udder width 12.38cm. Uda funnel shape on the other hand body weight 38.51kg, udder length 12.43cm and udder width 12.03cm while Uda bowl shape had the lowest body weight 36.19 kg, udder length 11.79 cm, udder weight 11.90 cm, and udder volume 0.95m^3 respectively. There was no significant difference ($p<0.05$) between udder circumference, teat length, teat width, distance between teat and teat to floor distance. The result differs with the observation of Prajapati, *et al.* (1992) who reported that bowl shape udder was larger than round and irregular shape udder, and consequently produced more milk. The superiority of bowl udder over those;2 of other type also agreed with the report of (Singh, *et al*., 1993) on Holstein cows where bowl shape udder had well developed quarters and placed teat.

Table 5. Variation of udder shape of two breeds of sheep

Parameters	(Y) Bowl shape	(U) Bowl shape	(Y) funnel shape	(U) funnel shape ;8
BW (kg)	38.55^{ab}	36.19^{c}	43.32^{a}	38.51^{bc}
UL (cm)	14.05^{ab}	11.79^{c}	14.33^{a}	12.43^{bc}
UW (cm)	12.38^{b}	11.90^{c}	12.99^{a}	12.03^{bc}
UC (cm)	3.21^{c}	$3.85b^{c}$	3.92^{ab}	3.94^{a}
UV (m^3)	1.25^{ab}	0.95^{b}	1.37^{a}	1.25^{ab}
TL (cm)	2.58^{ns}	2.45^{ns}	2.72^{ns}	2.64^{ns}
TW (cm)	1.54^{ns}	1.48^{ns}	1.69^{ns}	1.44^{ns}
DBT (cm)	5.47^{ns}	5.69^{ns}	5.71^{ns}	6.00^{ns}
TFD (cm)	40.24^{ns}	40.23^{ns}	40.74^{ns}	42.12^{ns}

Where :(Y),Yankasa,(U) Uda, Bw: bodyweight, UL: udder length, UW: udder weight, UC: udder circumference, UV: udder volume, TL: teat length, UW: udder weight, DBT: distance between teat, TFD: teat to floor distance.

Variation of milk composition of two breed of sheep

Table 6 presents the milk composition of two breeds of sheep. There was no significant difference in protein (4.04%), fat (3.47%) and Ash (0.39%) content of milk among the breeds. However, lactose and casein content varied significantly between the breeds with Yankasa ewes having the highest value of lactose (4.51%) and casein (3.43%) while the Uda ewes had the lowest value. The observation is in line with the finding of Adewuni and Olorunnisomo, (2009) who observed that there were significant effects of breed on milk composition with Yankasa ewes having highest value in milk fat %, lactose %, solid fat % and total solid %. Compared to ruminant animal sheep milk are mostly higher than those in cow and goat. The casein protein whereas presents 50 % of total protein in human milk (Parka *et al.,* 2007). The result is similar with the finding of (Adewuni *et al*., 2009). There was no significant difference in protein and Ash content of milk among the breeds (Yankasa breed). However, fat and lactose content varied significantly between the breeds with Yankasa ewes having the highest value of fat and lactose. However, Adewuni and Olorunnisomo (2009) observed that fat content of Yankasa ewes was higher than crossbred ewes during the first lactation, however, during the second lactation fat content was similar for the breeds. Sugar content of Yankasa milk was higher than that of crossbred sheep during the first and second lactation. Fat content of sheep′s milk obtained in the study range between 6.77 and 7.54 %. These are much higher than the fat content reported by Ezekwe and Machebe, (2005) for Muturu cow′s milk which varied from 4.14 - 5.34 %. The implication of this is that sheep milk will yield more products per liter of milk during cheese and butter production.

Table 6. Variation of milk composition of two breeds of sheep.

Breed	Protein%	Fat%	Lactose%	Ash%	Casein%	Total solid %
Yankasa	4.04	3.47	4.51	0.39	3.43	7.48 ± 0.63
Uda	4.03	3.11	3.39	0.36	2.45	7.28 ± 0.

CONCLUSIONS

In terms of selection for breeding, Yankasa breed should be recommended as compares to Uda breed in the study area because of their larger body weight, udder and teat measurements which are highly correlated with milk production. Base on udder shape, funnel shape is superior to bowl shape of udder in body weight udder and teat measurements which produce more milk. The variation of milk composition of lactose and casein percentage of two breeds its can be due to genetic makeup, environmental difference or management practice.

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